Claims

[c1] A system for drilling a lateral hole departing from a main well, the system comprising:

a motor assembly (415) including:

a motor (412) to generate a rotating torque;

an axial thruster (411) to generate an axial force;

a blocking system (410) to fix the motor and the axial thruster downhole;

a drive shaft (414, 514, 614) to transmit the rotating torque; and

a connector (402, 404, 504, 602) for transmitting the rotating torque and the axial force from the motor assembly to a drill string assembly, the drill string assembly comprising a drill pipe (401, 501, 601) and a drill bit (403), the connector providing a fluid communication channel (416, 516, 616) between the motor assembly and an inside of the drill pipe; wherein the connector is one of a first connector (404, 504) or a second connector (402, 602), the first connector being connectable to the drill string assembly so as to transmit the axial force only to the drill pipe, and to transmit the rotating torque to a further drive shaft (405, 505) positioned within the drill pipe, and the second connector being connectable to the drill string assembly so as to transmit both the axial force and the rotating torque to the drill pipe.

[c2] The system of claim 1 wherein the motor (412) is located within the main well.

[c3] The system of claim 2, further comprising:

the drill string assembly, the drill string assembly being connected to the connector, the drill string assembly comprising

the drill pipe (401, 501) to transmit the axial force; and

the further drive shaft (405, 505) to transmit the rotating torque, the further drive shaft being positioned within the drill pipe;

the drill bit (403).

[c4] The system of claim 3 wherein :

a portion of the lateral hole comprises a curved hole (710) having a determined radius of curvature;

the drill string assembly comprises three contact points (702) to be in contact with a wall of the drilled lateral hole, the three contact points defining a drill pipe angle so as to allow to drill the curved hole.

[c5] The system of claim 4, further comprising

a thrust bearing (708) to transmit the axial force from the drill pipe (705) to the drill bit (707), the drill bit being located at an end of the further drive shaft (703);

a plain bearing system (711) to support a flexion of the further drive shaft within the drill pipe.

[c6] The system of claim 5, wherein the motor (704) is electrical.

[c7] The system of claim 2, further comprising :

the drill string assembly, the drill string assembly being connected to the connector (402, 602), the drill string assembly comprising

the drill pipe (401, 601) to transmit both the axial force and the rotating torque;

the drill bit (403).

[c8] The system of claims 1 or 2, further comprising :

at least one variable diameter stabilizer (905, 906, 1001, 1002) to position the drill bit (903) within a section of the lateral hole (904);

controlling means to mechanically control from a remote location at least one stabilizer parameter among a set of stabilizer parameters, the set of

stabilizer parameters comprising a diameter size of a determined variable diameter stabilizer, a distance between a first stabilizer and a mark device inside the lateral hole, the mark device being any one of a distinct stabilizer or a drill bit, a coordinated retracting of at least two variable diameter stabilizers (905, 906, 1001, 1002), and a azimuthal radius of the determined variable diameter stabilizer.

[c9] The system of claim 8, further comprising
a single control unit to control at least one stabilizer parameter among the set of stabilizer parameters.

[c10] The system of claim 9, the system comprising:
a configuration slot (1025);
a configuration plot (1021) that may be displaced by the controlling means, the configuration plot allowing to select among a set of setting positions (i, j, k, l, m, n) a desired setting position;
wherein:
the set of setting positions comprises at least three setting positions;
each setting position corresponds to a determined value of the at least one stabilizer parameter.

[c11] The system of claim 10, the system comprising two variable diameter stabilizers (905, 906, 1001, 1002), wherein the two variable diameter stabilizers may be set in a coordinated fashion.

[c12] The system of claim 11, further comprising a Hall Effect sensor (907) to measure a diameter of one of the two variable diameter stabilizers (905, 906).

[c13] The system according to any one of claims 1 to 12, the system further comprising at least one micro-sensor (1207, 1208) in a close neighborhood of the drill bit

(1201), the at least one micro-sensor allowing a measurement of an orientation of the drill bit relative to a reference direction.

[c14] The system of claims 1, 2 or 7, wherein

the drill pipe (1301, 1401) is flexible, so as to allow a bending while transmitting the rotating torque and the axial force;

the system further comprises :

a bending guide (1305) with rotating supports (1306, 1406) to support the drill pipe (1301, 1401) at the bend.

[c15] The system of claim 14, wherein :

the rotating supports are belts (1406) being supported by a pulley (1407).

[c16] The system of claim 2, further comprising :

a pump (1804) located downhole to pump a drilling fluid.

[c17] The system of claim 16, wherein :

the drilling fluid may circulate from the main well (1502) to the drill bit (1507) through an annulus (1504) between the drilled lateral hole (1501) and the drill string assembly (1503);

the drilling fluid may circulate from the drill bit to the main well through the fluid communication channel (1506).

[c18] The system of claim 17, wherein :

the drill bit (1607) comprises a bit hole (1603) allowing to evacuate cuttings generated at the drill bit (1607) through the drill bit (1607);

the drill bit (1607) comprises a main blade (1601) to insure a cutting action.

[c19] The system of claim 16, further comprising :

a passage (1704, 1810) located at an output of the lateral hole (1702, 1802), the passage allowing to guide a flow of drilling fluid from the lateral hole into the main well (1703, 1803).

[c20] The system of claim 19, further comprising:
a sealing device (1811) to force the drilling fluid to circulate through the passage (1810).

[c21] The system of claim 19 or to claim 20, wherein the passage (1704) is oriented downward.

[c22] The system of any one of claims 16, 19 , 20 or 21, further comprising :
a filter device (1805, 1901) for separating cuttings from the drilling fluid, the filter device being located downhole.

[c23] The system of claim 22, further comprising :
a compactor (1903, 1904) within the filter device (1901) to regularly provide a compaction of the filtered cuttings (1905, 1906).

[c24] The system of claim 22 or claim 23, further comprising :
an adaptive system (1902, 1909) within the filter device (1901) to sort the filtered cutting (1905, 1906) depending on their size so as to avoid the filtered cuttings to cork the filter device.

[c25] The system of any one of claims 16, 19 20 or 21, further comprising :
a container (2004) within the main well (2002) to collect cuttings below the lateral hole (2001).

[c26] The system of any one of claims 16 or 25, further comprising :
a cuttings collector unit (2100) comprising an housing (2102) and a screw (2101) to pull the cuttings into the housing.

[c27] The system according to claim 16, further comprising:

a surface pump (2204) to generate a secondary circulation flow along a tubing (2207), the secondary circulation flow allowing to carry to the surface cuttings generated at the drill bit (2207) and carried by a primary circulation flow from the drill bit to the secondary circulation flow.

[c28] The system according to claim 26, further comprising:

a flow guide (2301) allowing the primary circulation flow to circulate at a relatively high flow velocity between the lateral hole (2303) and the tubing (2304) so as to avoid a sedimentation of the cuttings.

[c29] The system of claim 1, wherein the motor (412) is located within the drilled lateral hole.

[c30] A method for drilling a lateral hole departing from a main well, the method comprising :

blocking a motor (412) and an axial thruster (411) downhole, the motor and the axial thrusters respectively allowing to generate a rotating torque and an axial force;

providing a connector (402, 404, 504, 602) for transmitting the rotating torque and the axial force from a motor assembly (415) to a drill string assembly, the motor assembly including the motor, the axial thruster and a drive shaft (414, 514, 614), the drill string assembly including a drill pipe (401, 501, 601) and a drill bit (403);

wherein :

the connector provides a fluid communication channel (416, 516, 616) between the motor assembly and the inside of the drill pipe;

the connector is either one of a first connector (404, 504) or a second connector (402, 602), the first connector being connectable to the drill string assembly so as to transmit the axial force only to the drill pipe, and to transmit the rotating torque to a further drive shaft (405, 505) positioned within the drill pipe, and the second connector being connectable to the drill string assembly so as to transmit both the axial force and the rotating torque to the drill pipe.

[c31] The method according to claim 30, wherein the motor (412) is located within the main well.

[c32] The method of claim 31, wherein the drill pipe (401, 501) transmits the axial force, and the further drive shaft (405, 505) transmits the rotating torque to the drill bit (403).

[c33] The method of claim 32, further comprising

controlling an effective radius of a curved hole (710) of the lateral hole, the controlling being performed by combining an angled mode to a straight mode, wherein:

during the angled mode, three contacts points (702) of the drill string assembly are in contact with a wall of the drilled lateral hole so as to allow to drill the curved hole; and

during the straight mode, the following steps are performed:

rotating the drill pipe (705) of a first angle;

transmitting the rotating torque and the axial force to the drill bit (707) for a first determined duration;

pulling the drill string assembly back over a determined distance;

rotating the drill pipe of a second angle;

transmitting the rotating torque and the axial force to the drill bit for a second determined duration.

[c34] The method of claim 33, wherein the controlling is performed by combining the angled mode and the straight mode to a jetting mode, the jetting mode comprising: providing a jet (712) of fluid to preferentially erode a formation (713) in a determined direction.

[c35] The method of claim 31, wherein the drill pipe (401, 601) transmits both the rotating torque and the axial force to the drill bit (403).

[c36] The method according to claim 30 or 31, further comprising :
mechanically controlling from a remote location at least one stabilizer parameter among a set of stabilizer parameters, the set of stabilizer parameters comprising a diameter size of a determined variable diameter stabilizer, a distance between a first stabilizer relative to a mark device, the mark device being any one of a distinct stabilizer or a drill bit, a retracting of at least two variable diameter stabilizers (905, 906, 1001, 1002), and an azimuthal radius of the determined variable diameter stabilizer.

[c37] The method according to claim 36, further comprising :
displacing a configuration plot (1021) within a configuration slot (1025), so as to select a desired setting position among a set of setting positions (i, j, k, l, m, n) comprising at least three setting positions, each setting position corresponding to a determined value of the at least one stabilizer parameter.

[c38] The method according to claim 30, 31 or 35, wherein :
the drill pipe (1301, 1401) is flexible, so as to allow a bending while transmitting the rotating torque and the axial force;

the drill pipe is supported at the bend by a bending guide (1305) comprising rotating supports (1306, 1406).

[c39] The method according to any one of claims 30 to 38, the method further comprising monitoring an orientation of the drill bit (1201) relative to at least one reference direction with at least one micro sensor (1207, 1208) located in a close neighbourhood of the drill bit.

[c40] The method according to claim 31, further comprising :
generating a circulation of a drilling fluid to the drill bit (1807) with a pump (1804) located downhole.

[c41] The method according to claim 40, wherein :
the drilling fluid circulates to the drill bit (1507) through an annulus (1504) between the drilled lateral hole (1501) and the drill string assembly (1503);
the drilling fluid circulates from the drill bit through the fluid communication channel (1506).

[c42] The method according to claim 40, the method further comprising guiding the drilling fluid at an output of the lateral hole (1702, 1802) through a passage (1704, 1810) having a predetermined orientation.

[c43] The method according to claim 42, wherein the drilling fluid is guided downward.

[c44] The method according to claim 40, 41, 42 or 43, further comprising downhole filtering cuttings from the drilling fluid.

[c45] The method according to claim 44, further comprising compacting the filtered cuttings (1905, 1906) inside a filter device (1901).

[c46] The method according to claim 44 or 45, further comprising sorting the filtered cuttings (1905, 1906) according to their size so as to avoid the filtered cuttings to cork the filter device (1901).

[c47] The method according to any one of claims 40, 42 or 43, further comprising collecting cuttings downhole at a location below the lateral hole (2001, 2114).

[c48] The method according to claim 40, further comprising:
generating a secondary circulation flow along a tubing (2207), the secondary circulation flow allowing to carry to the surface cuttings generated at the drill bit (2207) and carried by a primary circulation flow from the drill bit to the secondary circulation flow.

[c49] The method of claim 30, wherein the motor (412) is located within the drilled lateral hole.